U.S. DEPARTMENT OF ENERGY
DEPARTMENT-WIDE
FUNCTIONAL AREA QUALIFICATION STANDARD

NUCLEAR EXPLOSIVES SAFETY QUALIFICATION STANDARD

Defense Nuclear Facilities Technical Personnel

U.S. Department of Energy
Washington, D.C. 20585

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The Assistant Secretary for Defense Programs is the Management Sponsor for the Department-wide Nuclear Explosives Safety Functional Area Qualification Standard. The Management Sponsor is responsible for reviewing the Qualification Standard to ensure that the technical content is accurate and adequate for Department-wide application. The Management Sponsor, in coordination with the Human Resources organization, is also responsible for ensuring that the Qualification Standard is maintained current. Concurrence with this Qualification Standard by the Assistant Secretary for Defense Programs is indicated by the signature below.

The Technical Personnel Program Coordinator (TPPC) is responsible for coordinating the consistent development and implementation of the Technical Qualification Program throughout the Department of Energy. Concurrence with this Qualification Standard by the Technical Personnel Program Coordinator is indicated by the signature below.

The Technical Excellence Executive Committee (TEEC) consists of senior Department of Energy managers. This Committee is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Technical Excellence Executive Committee is indicated by the signature below.

NOTE: The signatures below reflect concurrence and approval of this Qualification Standard for interim Implementation. Final concurrence and approval will occur in December 1995, pending comments received based upon implementation.

CONCURRENCE:

Assistant Secretary for Defense Programs	Technical Personnel Program Coordinator

APPROVAL:

Chairman
Technical Excellence Executive Committee

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FUNCTIONAL AREA

Nuclear Explosives Safety

PURPOSE

The Technical Qualification Program is divided into three levels of technical competence and qualification. The General Technical Base Qualification Standard establishes the base technical competence required of all Department of Energy defense nuclear facility technical personnel. The Functional Area Qualification Standards build on the requirements of the General Technical Base Qualification Standard and establish Department-wide functional competency requirements in each functional area. Office/facility-specific Qualification Standards establish unique operational competency requirements at the Headquarters or Field element, site, or facility level.

The Nuclear Explosives Safety Functional Area Qualification Standard establishes common functional area competency requirements for all Department of Energy nuclear explosives safety technical personnel who provide management direction or oversight impacting the safe operation of defense nuclear facilities. Satisfactory and documented completion of the competency requirements contained in this Standard ensures that technical personnel possess the minimum requisite competence to fulfill their functional area duties and responsibilities. Additionally, these competency requirements provide the functional foundation to assure successful completion of the appropriate Office/facility Specific Qualification Standard.

APPLICABILITY

This Standard applies to all Department of Energy nuclear explosives safety technical personnel who provide management direction or oversight impacting the safe operation of defense nuclear facilities. Personnel designated by Headquarters or Field element line management as participants in the Technical Qualification Program are required to satisfy the competency requirements of this Standard as defined in DOE Order 360.1, Training.

IMPLEMENTATION REQUIREMENTS

The competencies contained in the Standard are divided into the following four categories:

1. General Technical
2. Regulatory
3. Administrative
4. Management, Assessment, and Oversight

Each of the categories is defined by one or more competency statements indicated by bold print. The competency statements define the expected knowledge and/or skill that an individual must possess and are requirements. Each of the competency statements is further explained by a listing of supporting knowledge and/or skill statements. The supporting knowledge and/or skill

statements are not requirements and do not necessarily have to be fulfilled to meet the intent of the competency.

The competencies identify a familiarity level, a working level, or an expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

> **Familiarity level** is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.
>
> **Working level** is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.
>
> **Expert level** is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.
>
> **Demonstrate the ability** is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field elements shall establish a program and process to ensure that all defense nuclear facility technical personnel required to participate in the Technical Qualification Program meet the competency requirements contained in this Standard. Documentation of the completion of the requirements of this Standard shall be included in the employee's training and qualification record.

In selected cases, it may be necessary to exempt an individual from completing one or more of the competencies in this Functional Area Qualification Standard. Exemptions from individual competencies shall be justified and documented in accordance with DOE Order 360.1, Training. Exemptions shall be requested by the individual's immediate supervisor, and approved one level above the individual's immediate supervisor.

Equivalencies may be granted for individual competencies based upon an objective evaluation of the employee's prior education, experience, and/or training. Documentation of equivalencies shall indicate how the competency requirements have been met. The supporting knowledge and/or skill statements should be considered when evaluating an individual's ability with respect to each competency requirement.

Training shall be provided to employees in the Technical Qualification Program who do not meet the intention of the competencies contained in the Qualification Standard. Departmental training will be based upon supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training courses used to provide individuals with the requisite knowledge and/or skill required to meet the intent of the Qualification Standard competency statements.

DUTIES AND RESPONSIBILITIES

The following are duties and responsibilities normally expected of defense nuclear facility technical personnel assigned to the nuclear explosives safety functional area:

A. Evaluates the requirement for, plans, and prepares Nuclear Explosive Safety (NES) Studies and Nuclear Explosive Safety (NES) Surveys.

B. Maintains communication with Department of Energy line management regarding operations involving nuclear explosives and facilitates the notification and reporting of occurrences and/or safety/operations concerns.

C. Presents Nuclear Explosive Safety (NES) Study results to management.

D. Processes requests for administrative approval of deviations/modifications to a nuclear explosive operation or requirement.

E. Monitors and verifies implementation (follow-up and close-out) of recommendations.

F. Conducts compliance appraisals of implementation of Department of Energy Orders and Nuclear Explosive Safety (NES) Study and Nuclear Explosive Safety (NES) Survey recommendations.

G. Monitors and assesses contractor conduct of operations.

H. Reviews nuclear explosive safety policies, standards, guidelines, orders, and procedures as required to ensure the adequacy of the Nuclear Explosive Safety Program.

I. Evaluates standards in applicable statutes, regulations, and other non-nuclear explosive safety Department of Energy Orders to ensure that compliance with these standards does not compromise nuclear explosive safety.

J. Reviews and evaluates the Safety Analysis Report and other safety basis documentation to ensure that planned operations are within the approved safety envelope.

K. Maintains cognizance of the specific safety hazards associated with nuclear explosive devices and operations.

Additional duties and responsibilities specific to the site, facility, operational activities, and/or other involved organizations shall be contained in the Office/facility Specific Qualification Standard(s).

BACKGROUND AND EXPERIENCE

The U.S. Office of Personnel Management's Qualification Standards Handbook establishes minimum education, training, experience, or other relevant requirements applicable to a particular occupational series/grade level, as well as alternatives to meeting specified requirements.

The preferred education and experience for nuclear explosives safety personnel is:

1. Education:

Bachelor of Science degree in engineering or a related technical discipline; or meeting the alternative requirements specified in the Qualifications Standards Handbook.

2. Experience:

   Industrial, military, Federal, state, or other directly related background that has provided specialized experience in nuclear explosive safety, design, assembly/disassembly, maintenance, testing, transportation, handling, and storage. Specialized experience can be demonstrated through possession of the competencies outlined in this Standard.

REQUIRED COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All nuclear explosives safety personnel must complete the competency requirements of the General Technical Base Qualification Standard prior to, or in parallel with, the completion of the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and/or skill that an individual must possess to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements.

1. GENERAL TECHNICAL

1.1 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the internal design of nuclear explosive/weapon systems, components and mechanisms.

Supporting Knowledge and/or Skills

a. Discuss the function, purpose, and design of the following systems and components:

- Arming
- Fusing
- Firing
- High explosives
- Fusionable material
- Fissile material - primary and secondary
- Detonators
- Boosting device
- Neutron generators (zippers)
- Ancillary hazardous systems

b. Describe the nuclear explosive/weapon command and control features with respect to the following:

- Personnel
- Electronics
- Mechanics/required signals - PAL (permissive action link)

c. Discuss the principles of nuclear weapon design specific to the following:

- Stockpile-to-Target Sequence
- Military Characteristics

d. State and discuss the nuclear weapon design safety criteria from DOE Order 5610.10, Nuclear Explosive and Weapon Surety Program including:

- Normal environment
- Abnormal environment
- One-point safety
- Dispersal safety

e. Discuss nuclear detonation safety design principles and describe nuclear explosive components/features that have been employed to provide isolation, inoperability, and incompatibility, including:

- Barriers
- Weak links
- Strong links
- Unique signals

f. Discuss the role of independence and first principles in the implementation of the nuclear detonation safety design principles (safety theme).

g. Describe nuclear explosive design features that have been employed to prevent/mitigate fissile material dispersal including:

- Insensitive high explosives
- Fire-resistant pits

1.2 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the radiological, equipment, and personnel hazards associated with nuclear explosives/weapons.

Supporting Knowledge and/or Skills

a. Discuss the radiological characteristics, and related hazards to personnel and equipment from the following materials used in nuclear explosives/weapons:

- Uranium
- Plutonium
- Tritium

b. Discuss the general quantity and configuration of the materials used in nuclear explosives/weapons that present a potential radiological hazard to personnel and equipment.

c. Describe how as-low-as-reasonably-achievable (ALARA) considerations are incorporated into the procedures for the handling and storage of nuclear explosives/weapons.

d. Identify the hazards to personnel and equipment from each of the following features of nuclear explosive/weapon design:

- Spin rockets
- Retarding devices
- Pre-flight controllers
- Boosting device

e. Describe toxic materials typically found in nuclear explosives and weapons, the hazards associated with them, and the safety precautions that should be taken.

f. Describe the physical effects of a high explosive detonation and a nuclear detonation in terms of:

- Blast
- Radiation
- Thermal

1.3 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the criticality process and its application to nuclear explosive/weapon design and operations.

Supporting Knowledge and/or Skills

a. Discuss the following processes and their application in nuclear explosive/weapon design:

- Nuclear fission
- Nuclear fusion

b. Define the term "fissile materials" and give examples applicable to nuclear explosive/weapon design.

c. Describe the effects of each of the following on critical mass:

- Reflectors
- Absorbers
- Moderators
- Stray neutrons
- Geometry
- Poisons
- Enrichment

d. Describe the methods used during the assembly, disassembly, transportation and storage of nuclear explosives/weapons to prevent criticality.

e. Describe the criticality effects and criticality hazards associated with nuclear explosives/weapons in terms of personnel radiation exposure.

f. Describe how each of the following categories of neutron interacting materials is used in, or may affect, the safe packaging, stacking, and storage of nuclear explosives/weapons. Give examples of materials and/or components within each category.

- Reflectors
- Absorbers
- Moderators

1.4 Nuclear explosives safety personnel shall demonstrate a working level knowledge of high explosives and their applicability in nuclear explosives/weapons.

Supporting Knowledge and/or Skills

a. Define the following terms:

- Conventional high explosives (CHE)
- Insensitive high explosive (IHE)
- One point detonation

b. Discuss the difference between insensitive high explosives (IHE) and conventional high explosives (CHE) used in nuclear explosives/weapons.

c. Describe the function of primary and secondary explosives in nuclear explosive/weapon design.

d. Define and compare the effects of the following interrelated high explosive terms that apply to nuclear explosive/weapon design:

- Detonations
- Violent reactions
- Deflagration
- Combustion

e. Describe the response of high explosives used in nuclear explosive/weapon design to the following external stimuli:

- Mechanical
- Electrical
- Thermal

f. Discuss the effects of aging on the high explosive materials used in nuclear explosive/weapon design.

g. Discuss the toxic properties of the high explosive materials used in nuclear explosive/weapon design.

1.5 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the effects of abnormal environments on nuclear explosives/weapons.

Supporting Knowledge and/or Skills

a. Define the term "abnormal environment."

b. List the categories of abnormal environments specific to nuclear explosive/weapon operations and storage, and describe the characteristics of each.

c. Given a set of conditions that make up an abnormal environment for a nuclear explosive/weapon, assess and evaluate a single abnormal environment including the credibility of multiple abnormal environments. Include the following in the evaluation:

- Identifying hazards
- Identifying the effects on the nuclear explosive
- Identifying mitigating measures to be taken

1.6 Nuclear explosives safety personnel shall demonstrate a working level knowledge of tooling, testers, rigging, and hoisting equipment used for handling nuclear explosives/weapons.

Supporting Knowledge and/or Skills

a. Explain how the design of each of the following is important in minimizing or eliminating the potential for mishandling nuclear explosives/weapons and preventing accidents.

- Tooling
- Testers
- Rigging equipment
- Hoisting equipment

b. Read and interpret design drawings and technical specifications for the tooling, testers, rigging, and hoisting equipment used in handling nuclear explosives/weapons.

c. Explain the importance of proper certification of slings and hoisting equipment used in handling nuclear explosives/weapons.

d. Explain the importance of proper certification of testers used in nuclear explosives/weapons operations.

1.7 Nuclear explosives safety personnel shall demonstrate a working level knowledge of fire protection systems and their effects on nuclear explosive/weapon safety.

Supporting Knowledge and/or Skills

a. List the various types of fire protection systems that service nuclear explosive areas

and describe the effects of their use on the safety of nuclear explosive operations and associated activities.

b. Discuss the provisions contained in joint DOE/DOD Technical Publication 20-11, General Fire Fighting Guidance, and apply each to a fire situation involving nuclear explosives/weapons.

1.8 Nuclear explosives safety personnel shall demonstrate a working level knowledge of facility system interfaces and their potential effects on nuclear explosives.

Supporting Knowledge and/or Skills

a. Identify the potential hazards that pneumatic and hydraulic systems present to the safety of nuclear explosive operations and associated activities.

b. State the purpose and significant features of heating, ventilation, and air-conditioning systems that service nuclear explosive areas and discuss the effects of these systems in normal and abnormal environments.

c. Describe the hazards presented to the safety of nuclear explosive operations and associated activities by the introduction of alternating current (AC) and direct current (DC) electrical energy sources, or equipment using any electrical source, into a nuclear explosive area.

d. Describe the controls and design measures to prevent or limit the introduction of electrical energy into a nuclear explosive area.

1.9 Nuclear explosives safety personnel shall demonstrate a working level knowledge of safety analysis techniques and their application to nuclear explosive operations, facilities, and associated activities.

Supporting Knowledge and/or Skills

a. Describe the following hazard evaluation techniques and the types of results they produce:

- Checklist analysis
- Preliminary hazard analysis
- What-if analysis
- Hazard and operability analysis
- Failure modes and effects analysis
- Fault tree analysis
- Event tree analysis
- Human reliability analysis

b. Describe the bases upon which to judge the adequacy of a hazard evaluation including:

- Thoroughness of hazard identification

- Rigor of analysis versus complexity of operation and potential consequences of accidents
- Conservatism of assumptions
- Applicability of data
- Consistency and control of expert elicitation process
- Validity and conservatism of scenario screening criteria
- Reflection of lack of knowledge in uncertainty estimates

c. Describe the influence the following parameters have on the results of a radiological consequence analysis:

- For high explosive violent reaction, high explosive charge mass and pit fissile material mass
- High explosive burn versus violent reaction
- Plutonium versus enriched uranium
- Population distribution
- Wind speed and direction
- Atmosphere stability

1.10 Nuclear explosives safety personnel shall demonstrate the ability to interpret nuclear explosive design drawings and electrical schematics.

Supporting Knowledge and/or Skills

a. Identify the symbols and/or codes used on design drawings and specifications to depict the relationship between components.

b. State the condition in which all electrical devices are shown, unless otherwise noted on the diagram or schematic.

c. Given a simple electrical schematic and initial conditions, identify the power sources and/or loads and their status.

2. REGULATORY

NOTE: When Department of Energy (DOE) directives are referenced in the Qualification Standard, the most recent revision should be used.

2.1 Nuclear explosives safety personnel shall demonstrate an expert level knowledge of the Department of Energy (DOE) policy, objectives, standards and criteria, authorities, and responsibilities as described in DOE Order 5610.10, Nuclear Explosive and Weapon Surety Program.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope and applicability of DOE Order 5610.10, Nuclear Explosive and Weapon Surety Program.

b. Define the following terms that are used in DOE Order 5610.10, Nuclear Explosive and Weapon Surety Program:

- Abnormal environment
- Environment, Safety, and Health (ES&H)
- Normal environment
- Nuclear explosive
- Nuclear weapon
- Nuclear explosive operation
- Nuclear explosive operation associated activities
- Nuclear Explosive Safety (NES)
- Positive measures

c. Discuss the Nuclear Explosive and Weapons Surety Program policy and objectives and describe its basic elements.

d. Explain the line management responsibilities within the Nuclear Explosive and Weapons Surety Program.

e. Discuss the nuclear explosive surety standards established in DOE Order 5610.10, Nuclear Explosive and Weapons Surety, and their application to nuclear explosive operations.

2.2 Nuclear explosives safety personnel shall demonstrate an expert level knowledge of the policy, procedures, authorities, and responsibilities established to ensure safe conduct of nuclear explosive activities as described in DOE Order 5610.11, Safety of Nuclear Explosive Operations.

Supporting Knowledge and/or Skills

a. Discuss the policy, objectives, and applicability of DOE Order 5610.11, Safety of Nuclear Explosive Operation.

b. Define the following terms used in DOE Order 5610.11, Safety of Nuclear Explosive Operation:

- Access
- Custody
- Fissile Material Contamination
- Fissile Material Dispersal
- High explosive deflagration
- High explosive detonation
- Nuclear detonation
- Nuclear explosive area
- Nuclear explosive duty
- One-point-safe nuclear explosive

c. Discuss the program requirements for initial training and qualifying of Department of Energy and DOE contractor personnel for assignment to nuclear explosive duties as described in DOE Order 5610.11, Safety of Nuclear Explosive Operations.

d. Explain the two-person concept for operations involving nuclear explosives.

e. Discuss the nuclear explosive safety standards in DOE Order 5610.11, Safety of Nuclear Explosive Operations, to prevent unintended nuclear detonation or fissile material dispersal.

f. Discuss the general nuclear explosive safety rules established in DOE Order 5610.11, Safety of Nuclear Explosive Operations, for all Department nuclear explosive operations.

g. Explain why the following are needed to ensure the safe conduct of nuclear explosive operations and associated activities:

- Nuclear Explosive-Like Assembly (NELA) requirements
- Permanent Marking Instructions
- Control of Electrical Testers/Equipment

2.3 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the Nuclear Explosive Safety Study Group (NESSG), and the Nuclear Explosive Safety Study (NES Study), Nuclear Explosive Safety Survey (NES Survey), and Nuclear Explosive Safety Review (NES Review) processes described in the following Department of Energy (DOE) directives:

- **DOE Order 5610.11, Safety of Nuclear Explosive Operations**
- **DOE-STD-YYYY-95, Nuclear Explosive Safety Study Process (when issued)**

Supporting Knowledge and/or Skills

a. Describe the organization requirements for a Nuclear Explosive Safety Study Group (NESSG).

b. Describe the scope of the Nuclear Explosive Safety Study Group (NESSG) responsibilities.

c. Explain the functions of a NES Study, a NES Survey, and a NES Review.

d. Discuss DOE Order 5610.11, Safety of Nuclear Explosive Operations requirements for conducting a NES Study and NES Survey.

e. Explain how changes in each of the following types of planned operations could require a new NES Study and NES Survey:

- Dismantlement schedule
- Nuclear testing schedule
- Testing schedule
- New build and rebuild schedule
- Transportation schedule
- Revised programmatic/safety priorities
- Weapon custody

f. Describe the approval level requirements for a NES Study, a NES Survey, and a NES Review.

g. Explain the relationship between a Master Study and a specific study.

2.4 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of quality assurance requirements for nuclear explosive safety for the Department of Energy and its contractors as described in DOE Order 5700.6C, Quality Assurance, and 10 CFR 830.120, Quality Assurance.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and applicability of DOE Order 5700.6C, Quality Assurance, and 10 CFR 830.120, Quality Assurance.

b. Explain the line management responsibilities for quality assurance in the Nuclear Weapons and Explosives Safety Program covered under DOE Order 5700.6C, Quality Assurance, and 10 CFR 830.120, Quality Assurance.

2.5 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the Personnel Assurance Program described in the following Department of Energy (DOE) directives:

- **DOE Order 5610.11, Safety of Nuclear Explosive Operations**
- **DOE-STD-ZZZZ-95, Personnel Assurance Program (when issued)**

Supporting Knowledge and/or Skills

a. Discuss the purpose of the Personnel Assurance Program.

b. Discuss the responsibilities of management and supervisory personnel under the Personnel Assurance Program.

c. Discuss the Personnel Assurance Program certification requirements.

d. Describe the purpose for the immediate, temporary removal from nuclear explosive duties of an individual whose suitability for performing such duties is in question.

e. Explain the purpose of a Personnel Assurance Program certification list.

2.6 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of the following Department of Energy directives with respect to program requirements for nuclear explosive operations and associated activities:

- **DOE Order 5480.19, Conduct of Operations Requirements for DOE facilities**
- **DOE Order 5480.20A, Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities**
- **DOE Order 4330.4B, Maintenance Management Program**
- **DOE-STD-1073-93, Guide for Operational Configuration Management Programs**
- **DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information**

- **DOE Order 5480.26, Trending and Analysis of Operations Information Using Performance Indicators**
- **DOE-STD-1048-92, Performance Indicator Guidance Document**
- **DOE Order 5480.31, Startup and Restart of Nuclear Facilities**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the above regulation and Department directives with respect to program requirements for nuclear explosive operations and associated activities.

2.7 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of Department of Energy (DOE) Order 5480.21, Unreviewed Safety Questions, with respect to its impact on nuclear explosive operations and associated activities and facilities.

Supporting Knowledge and/or Skills

a. Discuss the reasons for performing an Unreviewed Safety Question determination.

b. Define the following terms:

- Accident analyses
- Safety evaluation
- Technical Safety Requirements

c. Describe the situations for which a safety evaluation is required to be performed.

d. Define the conditions for an Unreviewed Safety Question.

e. Discuss the actions to be taken if it is determined that an Unreviewed Safety Question is involved.

2.8 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of the Technical Safety Requirements as described in Department of Energy (DOE) Order 5480.22, Technical Safety Requirements, with respect to its impact on nuclear explosive operations and associated activities and facilities.

Supporting Knowledge and/or Skills

a. Discuss the purpose of Technical Safety Requirements.

b. Define the following terms and discuss the purpose of each:

- Safety Limit
- Limiting Control Settings
- Limiting Conditions for Operation

- Surveillance Requirements

c. Discuss the conditions that constitute a violation of the Technical Safety Requirements.

d. Discuss the requirements for administrative control of the Technical Safety Requirements.

e. Discuss the possible source documents that may be used in developing Technical Safety Requirements.

2.9 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of the following Department of Energy directives with respect to their impact on nuclear explosive operations and associated activities and facilities:

- **DOE Order 5480.23, Nuclear Safety Analysis Reports**
- **DOE-STD-XXXX-95, Preparation Guide for U.S. Department of Energy Hazard Analysis Reports for Nuclear Explosive Operation (when issued)**

Supporting Knowledge and/or Skills

a. Discuss the four basic purposes and objectives of Nuclear Safety Analysis Reports.

b. Describe the relationship between the Safety Analysis Report (SAR), the Hazards Analysis Report (HAR), and the Nuclear Explosive Hazard Assessment (NEHA).

c. Discuss the approval requirements for the Nuclear Safety Analysis Report for new facilities and subsequent changes to the Report.

d. Discuss the following in relation to the safety/hazard analysis reports:

- Operational Safety Controls (OSCs)
- Nuclear Explosive Safety Rules (NESRs)
- Technical safety requirements (TSRs)
- Safety structures, systems, and components (SSCs)

2.10 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of Department of Energy (DOE) Order 5480.24, Nuclear Criticality Safety, with respect to its impact on nuclear explosive operations and associated activities and facilities.

Supporting Knowledge and/or Skills

a. Discuss the purpose and policy associated with DOE Order 5480.24, Nuclear Criticality Safety.

b. Define the following terms associated with nuclear criticality safety:

- Criticality incident
- Double contingency principle
- Geometry control
- Nuclear criticality safety
- Significant quantity of fissionable material

c. Discuss the role of Department nuclear explosives safety personnel with respect to the implementation of the requirements of DOE Order 5480.24, Nuclear Criticality Safety and DOE-STD-XXXX-95, Preparation Guide for U.S. Department of Energy Hazard Analysis Reports for Nuclear Explosive Operations (when issued).

2.11 Nuclear explosives safety personnel shall demonstrate a familiarity level knowledge of the following Department of Energy directives:

- **DOE Order 5483.1A, Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities**
- **DOE Order 5480.11, Radiation Protection of the Public and the Environment**
- **DOE/EV/06194, DOE Explosive Safety Manual**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the above Department directives with respect to worker safety and health in nuclear explosive operations and associated activities and facilities.

b. Discuss the relationship that exists between the above directives and DOE Order 5610.11, Safety of Nuclear Explosive Operations.

3. ADMINISTRATIVE

NOTE: When Department of Energy (DOE) directives are referenced in the Qualification Standard, the most recent revision should be used.

3.1 Nuclear explosives safety personnel shall demonstrate a working level knowledge of the Department of Energy (DOE) organizational structure, its technical laboratories, relevant Department of Defense interfaces, and DOE contractor responsibilities.

Supporting Knowledge and/or Skills

a. Discuss the responsibilities and authorities for nuclear explosive safety of the following positions within the Department of Energy:

- Secretary of Energy (S-1)
- Assistant Secretary for Defense Programs (DP-1)
- Assistant Secretary for Environment, Safety, and Health (EH-1)
- Deputy Assistant Secretary for Military Application and Stockpile Support (DP-20)
- Office of Security Affairs (NN-50)
- Director of Security Evaluation (EH-4)
- Managers of Operations Offices

b. Discuss the lines of authority between the Department of Energy and its technical laboratories involved with nuclear explosive safety.

c. Describe the Department of Defense and Department of Energy interfaces relative to nuclear weapon safety.

d. Describe the relationship between the Department of Energy and its contractors regarding responsibility for nuclear explosive safety.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

NOTE: When Department of Energy (DOE) directives are referenced in the Qualification Standard, the most recent revision should be used.

4.1 Nuclear explosives safety personnel shall demonstrate the ability to plan, prepare, and perform a Nuclear Explosive Safety (NES) Study, a Nuclear Explosive Safety (NES) Survey, and a Nuclear Explosive Safety (NES) Review.

Supporting Knowledge and/or Skills

a. Given a set of conditions from which the need to perform a NES Study, a NES Survey, or a NES Review has been determined:

- Identify the scope of nuclear explosive safety operations, facilities, and equipment to be studied or surveyed.
- Describe the study group membership.
- Communicate Department of Energy (DOE) expectations of the conduct of the Nuclear Explosive Safety Study to all those who will participate in the study.
- Identify any potential concerns pertinent to the device being studied.
- Prepare a comprehensive draft report for the study.

b. During the planning and performance of a NES Study, a NES Survey, or a NES Review, coordinate the participation of contractors in the compilation, analysis, and evaluation of data.

c. During the planning and performance of a NES Study, a NES Survey, or a NES Review, evaluate the need for special briefings to provide supplemental information to study participants.

4.2 Nuclear explosives safety personnel shall demonstrate the ability to identify potential threats to nuclear explosive safety, and evaluate the adequacy of positive measures to assure nuclear explosive safety.

Supporting Knowledge and/or Skills

a. Evaluate nuclear explosive operations and all applicable technical data.

b. Evaluate nuclear detonation safety design and configuration during nuclear explosive operations including:

- Isolation:
  - Identify when barriers are breached during assembly/disassembly
  - Identify when strong links are absent or potentially bypassed.
- Incompatibility:
  - Identify available energy sources and their effects on nuclear explosive

components
- Identify available signals, such as in testers, that could drive a unique signal discriminator

· Inoperability:

- Identify defined weak links in various nuclear explosives
- Describe the features and safety role of the weak link(s)

c. Evaluate potential nuclear criticality risks associated with an operation or test to be performed.

d. Evaluate the description and analysis of the design safety features of a nuclear explosive.

e. Evaluate electrical tester designs, safety analyses, and tester/nuclear explosive interfaces.

f. Evaluate special tooling and written procedures used for nuclear explosive operations.

g. Evaluate facilities and associated equipment used for nuclear explosive operations.

h. Evaluate the adequacy of a Safety Analysis Report (SAR), a Hazard Analysis Report (HAR), and a Nuclear Explosive Safety Study (NES Study) input document (including Nuclear Explosive Hazards Assessment) and evaluate the associated:

· Hazard analyses
· Accident analyses
· Identification of safety-class and safety-significant Structures, Systems, Components
· Derivation of Technical Safety Requirements, Operational Safety Controls, and Nuclear Explosive Safety Rules

i. Evaluate the safety analyses of nuclear explosive pre-arming, arming, timing, and firing systems and procedures.

j. Analyze descriptions of countdowns, emergency stops and hold capabilities.

k. Analyze security operations for potential threats to a nuclear explosive.

l. Evaluate the on-site and off-site transportation of nuclear explosives.

m. Evaluate analyses of nuclear detonation responses of nuclear explosives to an abnormal environment.

4.3 Nuclear explosives safety personnel shall demonstrate the ability to identify conflicting requirements between other regulatory documents and nuclear explosive safety.

Supporting Knowledge and/or Skills

a. Given a set of conditions for a nuclear explosive operation, identify activities that present potential hazards or conflicts with DOE Order 5610.11, Safety of Nuclear Explosive Operations.

b. Given a set of conditions for a nuclear explosive operation where a potential hazard or conflict has been identified, develop and implement recommendations and/or guidelines to mitigate the identified hazards or conflicts.

4.4 Nuclear explosives safety personnel shall demonstrate the ability to review nuclear explosive safety Orders, policies, guidelines, and directives.

Supporting Knowledge and/or Skills

a. Given a proposed Order, policy, guideline, or directive, evaluate the document for adequacy, impact on the safety of nuclear explosive operations, and consistency with other policies, guidelines, and procedures.

4.5 Nuclear explosives safety personnel shall demonstrate the ability to process requests for administrative approval of deviations/modifications to a nuclear explosive operation.

Supporting Knowledge and/or Skills

a. Review requests for deviations to a nuclear explosive operation.

b. Document positions for administrative approval of requests for deviations to a nuclear explosive operation.

4.6 Nuclear explosives safety personnel shall demonstrate the ability to conduct appraisals to verify effective implementation of the Nuclear Explosive and Weapon Surety (NEWS) Program in accordance with the following Department of Energy (DOE) directives:

- **DOE Order 5610.10, Nuclear Explosive and Weapon Surety Program**
- **DOE-STD-BBBB-95, Nuclear Explosive Surety Program Appraisals (when issued)**

Supporting Knowledge and/or Skills

a. Explain the purpose of appraisals.

b. Perform a review of documents relating to nuclear explosive surety and verify compliance with Nuclear Explosive and Weapon Surety Program requirements.

c. Prepare a written appraisal guide that addresses each of the specific and general requirement areas, including but not limited to:

   - Verifying that appropriate organizations are in compliance with overall requirements of the DOE Order series 5610, related Orders, and DOE-STD-BBBB-95, Nuclear Explosive Surety Program Appraisals.

   - Verifying that specific operations authorized by approved studies are conducted as specified.

   - Verifying that criticality safety is properly considered in the operation of nuclear facilities

d. Deliver a close-out briefing to the organization for which an appraisal was conducted.

e. Prepare a final appraisal report.

f. Perform a follow-up of the appraisal to resolve findings as required.

4.7 Nuclear explosives safety personnel shall demonstrate a working level knowledge of variance, waiver, and exception requirements specified in DOE Order 5610.11, Safety of Nuclear Explosive Operations.

Supporting Knowledge and/or Skills

a. Define the following terms and describe the approval requirements for each:

   - Variance
   - Waiver
   - Exception

b. Describe the specific elements of information to be included with each request for a variance, waiver, or exception.

c. Describe the use of alternate or equivalent means to meet a specific requirement of DOE Order 5610.11, Safety of Nuclear Explosive Operations.

d. Using an actual or hypothetical request for a variance, waiver, or exception, evaluate the request for adequacy, completeness, and compliance with DOE Order 5610.11,

Safety of Nuclear Explosive Operations.

EVALUATION REQUIREMENTS

The following requirements shall be met to complete the Department-wide Nuclear Explosives Safety Functional Area Qualification Standard. The evaluation process identified below serves as a measurement tool for assessing whether the participants have acquired the technical competencies outlined in this Standard.

1. Documented completion of the Department-wide General Technical Base Qualification Standard in accordance with the requirements contained in that Standard.

2. Documented completion of the competency requirements listed in this Functional Area Qualification Standard. Documentation of the successful completion of these competency requirements may be satisfied by a qualifying official using any of the following methods:

   - Documented evaluation of equivalencies
   - Written examination
   - Documented oral evaluation
   - Documented observation of performance

CONTINUING TRAINING AND PROFICIENCY REQUIREMENTS

Nuclear explosives safety personnel shall participate in an Office/facility/position-specific continuing training and qualification program that includes the following elements:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of nuclear explosives safety personnel as determined by line management. This may include courses and/or training provided by:

   - Department of Energy

   - Other Government Agencies

   - Outside vendors

   - Educational institutions

2. Training covering topics that address identified deficiencies in the knowledge and/or skill of nuclear explosives safety personnel.

3. Training in areas added to the Nuclear Explosives Safety Functional Area Qualification Standard since initial qualification.

4. Specific continuing training requirements shall be documented in Individual Development Plans (IDPs).